65-2434RK
Carbon Monoxide Transmitter
Operator's Manual

Part Number: 71-0061RK

Revision: D

Released: 2/16/11

WARNING

Read and understand this instruction manual before operating detector. Improper use of the detector could result in bodily harm or death.

Periodic calibration and maintenance of the detector is essential for proper operation and correct readings. Please calibrate and maintain this detector regularly! Frequency of calibration depends upon the type of use you have and the sensor types. Typical calibration frequencies for most applications are between 3 and 6 months, but can be required more often or less often based on your usage.

Product Warranty

RKI Instruments, Inc. warranties gas alarm equipment sold by us to be free from defects in materials, workmanship, and performance for a period of one year from date of shipment from RKI Instruments, Inc. Any parts found defective within that period will be repaired or replaced, at our option, free of charge. This warranty does not apply to those items which by their nature are subject to deterioration or consumption in normal service, and which must be cleaned, repaired, or replaced on a routine basis. Examples of such items are:

a) Absorbent cartridges

b) Pump diaphragms and valves

c) Fuses

d) Batteries

e) Filter elements

Warranty is voided by abuse including mechanical damage, alteration, rough handling, or repair procedures not in accordance with the operator's manual. This warranty indicates the full extent of our liability, and we are not responsible for removal or replacement costs, local repair costs, transportation costs, or contingent expenses incurred without our prior approval.

THIS WARRANTY IS EXPRESSLY IN LIEU OF ANY AND ALL OTHER WARRANTIES AND REPRESENTATIONS, EXPRESSED OR IMPLIED, AND ALL OTHER OBLIGATIONS OR LIABILITIES ON THE PART OF RKI INSTRUMENTS, INC. INCLUDING BUT NOT LIMITED TO, THE WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. IN NO EVENT SHALL RKI INSTRUMENTS, INC. BE LIABLE FOR INDIRECT, INCIDENTAL, OR CONSEQUENTIAL LOSS OR DAMAGE OF ANY KIND CONNECTED WITH THE USE OF ITS PRODUCTS OR FAILURE OF ITS PRODUCTS TO FUNCTION OR OPERATE PROPERLY.

This warranty covers instruments and parts sold to users by authorized distributors, dealers, and representatives as appointed by RKI Instruments, Inc.

We do not assume indemnification for any accident or damage caused by the operation of this gas monitor, and our warranty is limited to the replacement of parts or our complete goods.

Table of Contents

Overview

This manual describes the 65-2434RK carbon monoxide (CO) transmitter. This manual also describes how to install, start up, maintain, and calibrate the transmitter. A parts list at the end of this manual lists replacement parts and accessories for the CO transmitter.

Specifications

Table 1 lists specifications for the CO transmitter.

Table 1: Specifications

Target Gas	Carbon monoxide (CO)
Sampling Method	Diffusion
Input Voltage	10 VDC - 30 VDC
Signal Output	4 - 20 mA
Detection Range	0 to 300 PPM (parts per million)
Accuracy	± 5% of reading or ± 5 ppm CO (whichever is greater)
Response Time	90% in 30 seconds

WARNING: ***When using the 65-2434RK, you must follow the instructions and warnings in this manual to assure proper and safe operation of the 65-2434RK and to minimize the risk of personal injury. Be sure to maintain and periodically calibrate the 65-2434RK as described in this manual.***

Description

This section describes the components of the CO transmitter. The transmitter consists of the CO sensor, charcoal filter, amplifier printed circuit board (PCB), and enclosure.

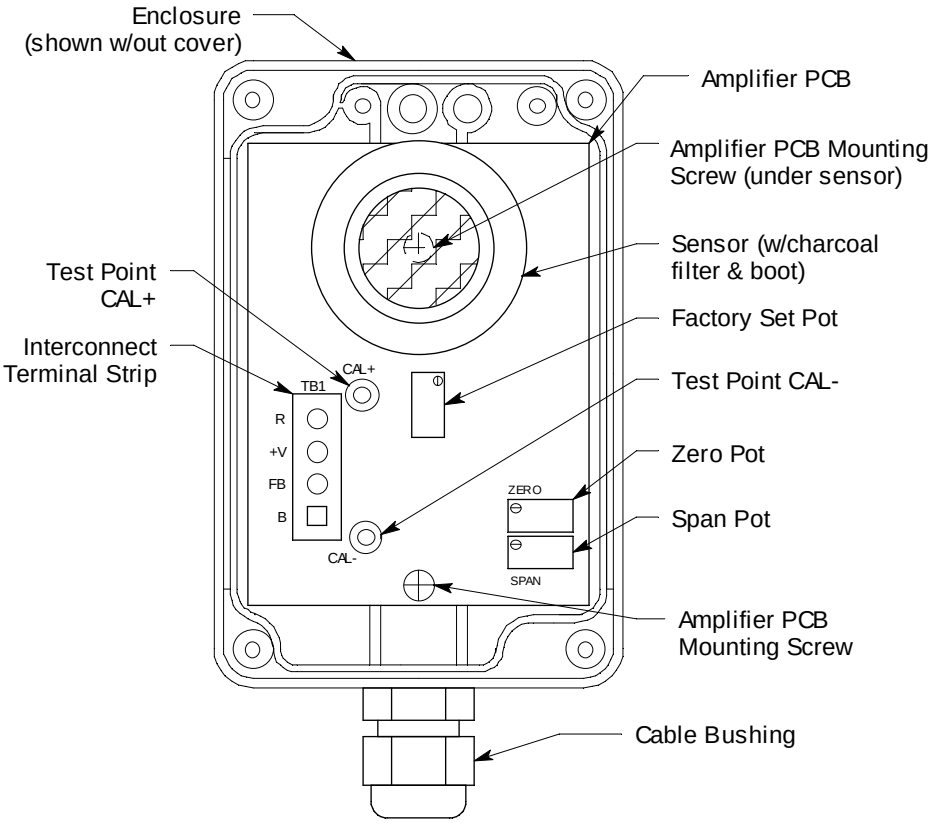

Figure 1: CO Transmitter Component Location

CO Sensor

The sensor is cylindrical with the sensing face on the top and the connection pins on the bottom. The sensor plugs into the amplifier PCB with the four pins. The sensor is exposed to the ambient air through an opening in the enclosure cover. Through a series of chemical and electrical reactions, the sensor produces an electrical output that is proportional to the detection range of the transmitter.

Charcoal Filter

The disc-shaped charcoal filter is secured to the sensing face of the sensor by a rubber boot. The filter prevents interference gases (hydrogen sulfide [H_2S] and certain hydrocarbons) from producing false CO readings.

Amplifier PCB

The amplifier PCB converts the electrical output from the sensor to a 4 to 20 mA signal (that is proportional to the detection range) and transmits the signal to a gas monitoring controller. The amplifier PCB includes the interconnect terminal strip, sensor sockets, span pot, zero pot, and test points (see Figure 1).

Interconnect Terminal Strip

The interconnect terminal strip is the four-point terminal strip on the lower left side of the amplifier PCB. Use the interconnect terminal strip to connect the transmitter to a controller.

Sensor Sockets

There are four sensor sockets located in a circular pattern near the top of the amplifier PCB. The sensor plugs into these sockets.

Span Pot

The span pot is near the bottom right corner of the amplifier PCB. Use the span pot to adjust the transmitter's response output during the calibration procedure.

Zero Pot

The zero pot is above the span pot. Use the zero pot to adjust the transmitter's target gas-free output during the start-up and calibration procedures.

CAUTION: *There is a third potentiometer on the PCB, the null potentiometer. It is factory-set. Do not adjust it.*

Test Points

The test points (labeled **CAL+** and **CAL-**) are on the right of the interconnect terminal strip. The test points produce a 100 - 500 mV output that is proportional to the transmitter's 4 - 20 mA output. Use the test points and a voltmeter to measure the transmitter's output during the start-up and calibration procedures.

Enclosure

The enclosure enables you to install the CO transmitter at a mounting site that is remote from the controller. The enclosure also protects the amplifier PCB and wiring connections made to the transmitter. Use the cable bushing on the bottom of the enclosure to connect wiring from the amplifier PCB to a controller.

Use the enclosure's two mounting holes, accessible with the cover removed, to mount the CO transmitter to a vertical surface at the monitoring site. Use the cover on the front of the enclosure to access the interior of the enclosure.

Installation

This section describes procedures to mount the CO transmitter in the monitoring environment and wire the transmitter to a gas monitoring controller.

Mounting the CO Transmitter

1. Select a mounting site that is representative of the monitoring environment. Consider the following when you select the mounting site.
   - Select a site where the transmitter is not likely to be bumped or disturbed. Make sure there is sufficient room to perform start-up, maintenance, and calibration procedures.
   - Select a site where the target gas is likely to be found first.

NOTE: If your application does not require a specific mounting site, mount the transmitter at approximately breathing level.

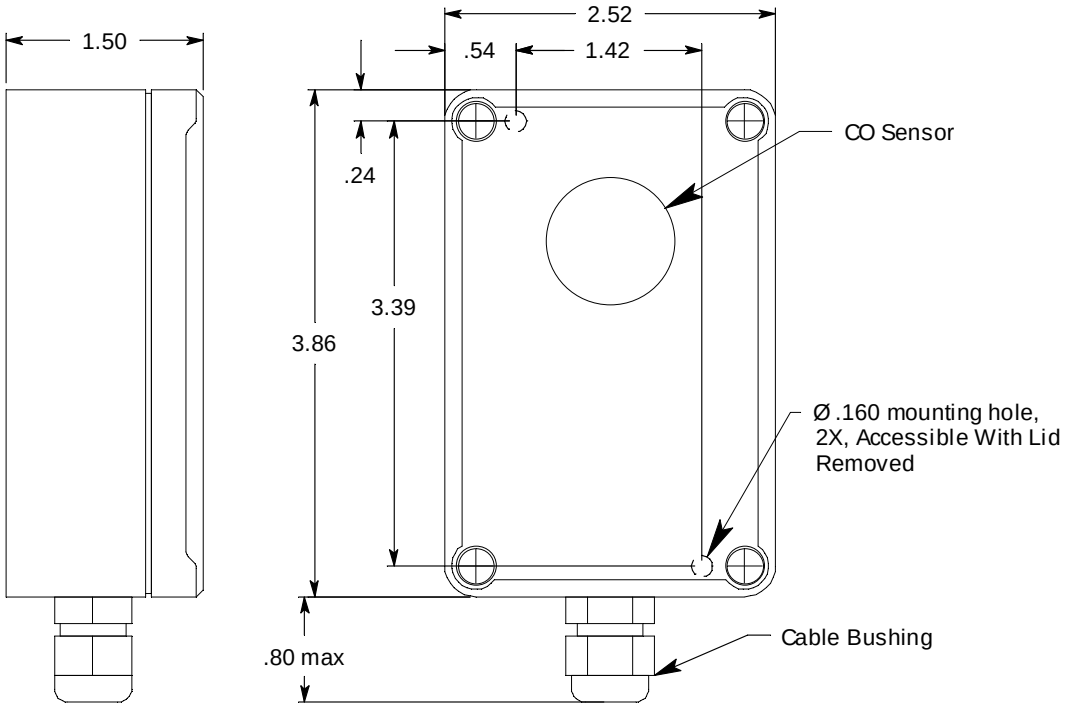

Figure 2: Mounting the CO Transmitter

2. Remove the enclosure's cover by unscrewing the four cover screws, one at each corner.
3. At the monitoring site, use #6 screws through the enclosure's two mounting holes to secure it to a vertical surface.
4. Secure the cover to the enclosure with the four cover screws.

Wiring the CO Transmitter to a Controller

WARNING: ***Always verify that the power source is off before you make wiring connections.***

1. Turn off the controller.
2. Turn off or unplug incoming power at the power source end.
3. Remove the enclosure's cover by unscrewing the four cover screws, one at each corner.
4. Guide a two-conductor, shielded cable through the cable bushing at the bottom of the enclosure.
5. Connect the two wires to the interconnect terminal strip as follows (see Figure 3.)
   - Connect the positive wire to the terminal labeled **+V**.
   - Connect the feedback wire to the terminal labeled **FB**.

CAUTION: *Leave the shield drain wire insulated and disconnected at the transmitter. You will connect the opposite end of the cable's drain wire at the controller.*

6. Secure the cover to the enclosure.
7. Route the cable leading from the CO transmitter through one of the conduit hubs at the controller housing.

CAUTION: *Do not route controller power and transmitter wiring through the same conduit hub. The power cable may disrupt the transmission of the transmitter signal to the controller.*

8. Connect the wires to the applicable controller transmitter terminal strip as shown in Figure 3 below.

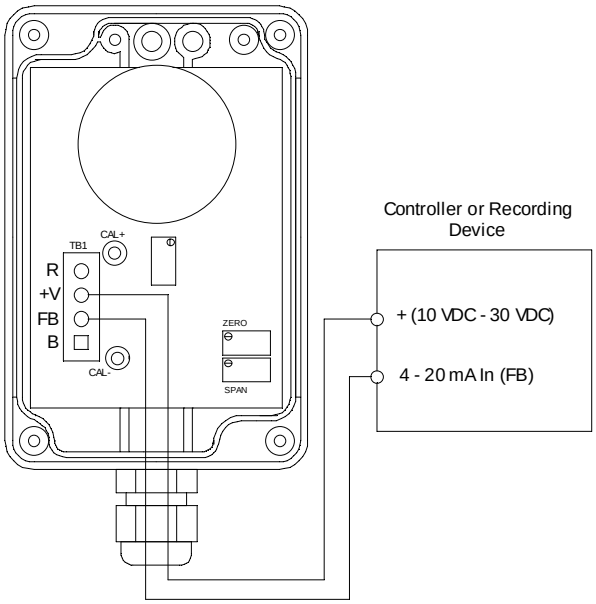

Figure 3: Wiring the CO Transmitter to a Controller

9. Connect the cable's drain to an available chassis ground at the controller. RKI controllers typically have a ground stud that can be used to ground the cable's drain wire.

Start Up

This section describes procedures to start up the CO transmitter and place the transmitter into normal operation.

Introducing Incoming Power

1. Complete the installation procedures described earlier in this manual.
2. Verify that the power wiring to the controller is correct and secure. Refer to the controller instruction manual.
3. Turn on or plug in the incoming power at the power source end, then turn on the controller.
4. Verify that the controller is on and operating properly. Refer to the controller operator's manual.

CAUTION: *Allow the transmitter to warm up for 5 minutes before you continue with the next section, "Setting the Zero Signal".*

Setting the Zero Signal

NOTE: If you can verify that the detector is in a fresh air environment (environment known to be of normal oxygen content and free of toxic and combustible gases), it is not necessary to apply zero air when verifying or setting the fresh air reading.

The procedure below describes applying zero emission air, usually called zero air, using a calibration kit that includes a calibration cup, calibration gas, sample tubing, and a fixed flow regulator with an on / off knob. RKI Instruments, Inc. recommends using a 0.5 LPM (liters per minute) fixed flow regulator.

1. Remove the enclosure's cover by unscrewing the four cover screws, one at each corner.
2. Set a voltmeter to measure in the millivolt (mV) range.
3. Plug the voltmeter leads into the test points on the amplifier PCB. Plug the positive lead into the test point labeled **CAL+**; plug the negative lead into the test point labeled **CAL-**.
4. Screw the regulator into the zero air calibration cylinder.
5. Use the sample tubing to connect the regulator to the calibration cup.
6. Turn the regulator's on / off knob counterclockwise to open it.
7. Hold the calibration cup against the CO sensor's face. Leave the rubber boot and sealing spacer on the sensor when calibrating. Hold the cup on gently to allow gas to escape and avoid pressurizing the sensor's sensing face.
8. Allow the gas to flow for 2 minutes.
9. Verify a voltmeter reading of 100 mV (±2 mV).

10. If necessary, use a flat-blade screwdriver to adjust the zero pot until the voltmeter reading is 100 mV (±2 mV).
11. Turn the regulator on / off knob clockwise to close it.
12. Remove the calibration cup from the sensor face.
13. Unscrew the regulator from the zero air calibration cylinder. For convenience, leave the sample tubing connected to the regulator and the calibration cup.
14. Store the components of the calibration kit in a safe and convenient place.
15. Remove the voltmeter leads from the test points.
16. Secure the cover to the enclosure.

Maintenance

This section describes maintenance procedures. It includes preventive maintenance, troubleshooting, and component replacement procedures.

Preventive Maintenance

This section describes a preventive maintenance schedule to ensure the optimum performance of the CO transmitter. It includes daily, monthly, and quarterly procedures.

Daily

Verify a display reading of 0 PPM CO at the controller. Investigate significant changes in the display reading.

Monthly

This procedure describes a test to verify that the CO transmitter responds properly to carbon monoxide.

NOTE: Performing a response test on the CO transmitter may cause alarms. Be sure to put the controller into its calibration program or disable external alarms before performing this test.

Preparing for the response test

1. Place the controller into its calibration program or disable external alarms.
2. Verify that the controller display reading for the channel you are testing is 0.

   If the display reading is not zero, set the zero reading of the transmitter as described in the Start Up section of this manual, then continue this procedure.
3. Assemble the calibration kit as described in the Calibration section of this manual.
4. Set a voltmeter to measure in the millivolt (mV) range.
5. Remove the enclosure cover, then plug the voltmeter leads into the test points on the amplifier PCB.

   Plug the positive lead into the test point labeled **CAL+**; plug the negative lead into the test point labeled **CAL-**.
6. Use the following formula to determine the correct test points output for the test sample.

   Output (mV) = (calibrating sample/fullscale) X 400 + 100

   For example, with a test sample of 50 PPM CO and a fullscale setting of

300 PPM, the correct output is 167 mV.

167 (mV) = (50/300) X 400 +100

Performing the response test

1. Turn the regulator's on / off knob counterclockwise to open it. Gas will begin to flow.
2. Hold the calibration cup against the CO sensor's face. Leave the rubber boot and charcoal filter on the sensor when calibrating. Hold the cup on gently to allow gas to escape and avoid pressurizing the sensor's sensing face.
3. When the reading on the voltmeter stabilizes, after approximately two minutes, verify that the reading is within ± 20% of the response reading you determined earlier.

NOTE: If the readings are not within ± 20% of the correct response reading, calibrate the transmitter as described in the Calibration section of this manual.

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4. Turn the regulator's on / off knob clockwise to close it.
5. Remove the calibration cup from the sensor face.
6. Unscrew the regulator from the calibration cylinder, then disassemble the calibration kit as described in the Calibration section of this insert.
7. When the display reading falls below the alarm setpoints, return the controller to normal operation.

Quarterly

Calibrate the CO transmitter as described in the Calibration section of this insert.

Troubleshooting

The troubleshooting guide describes symptoms, probable causes, and recommended action for problems you may encounter with the CO transmitter.

NOTE: This troubleshooting guide describes transmitter problems only. See the controller instruction manual for problems you may encounter with the controller.

Fail Condition

Symptoms

- The controller indicates a fail condition.

Probable causes

- The transmitter wiring is disconnected or misconnected.
- The transmitter's zero reading is low enough to cause a fail condition.
- The transmitter is malfunctioning.

Recommended action

- Verify that the transmitter wiring is correct and secure.
- Calibrate the transmitter.
- If the fail condition continues, replace the CO sensor.
- If the fail condition continues, contact RKI for further instruction.

Slow or No Response/Difficult or Unable to Calibrate

Symptoms

- The transmitter responds slowly or does not respond during the monthly response test.
- Unable to accurately set the zero or response reading during the calibration procedure.
- The transmitter requires frequent calibration.

NOTE: Under "normal" circumstances, the transmitter requires calibration once every three months. Some applications may require a more frequent calibration schedule.

Probable causes

- The calibration cylinder is low, out-dated, or defective.
- The transmitter is malfunctioning.

Recommended action

1. Verify that the calibration cylinder contains an adequate supply of a fresh test sample.
2. If the calibration / response difficulties continue, replace the CO sensor as described later in this section.
3. If the calibration / response difficulties continue, contact RKI Instruments, Inc. for further instruction.

Replacing Components of the CO Transmitter

This section includes procedures to replace the CO sensor, amplifier PCB, and charcoal filter.

Replacing the Sensor

1. Turn off the controller.
2. Turn off or unplug incoming power to the controller.
3. Remove the enclosure's cover by unscrewing the four cover screws, one at each corner.
4. Unplug the CO sensor from the amplifier PCB.
5. Remove the rubber boot and charcoal filter from the old sensor and install onto the replacement sensor.
6. Carefully plug the replacement sensor into the socket pattern on the amplifier PCB.

NOTE: Match the sensor's male pins with the four female sockets as you plug the sensor into the sockets.

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7. Secure the cover to the enclosure.
8. Turn on or plug in incoming power to the controller.
9. Turn on the controller.

CAUTION: *Allow the replacement sensor to warm up for 5 minutes before you continue with the next step.*

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10. Calibrate the replacement sensor as described in the Calibration section of this manual.

Replacing the Amplifier PCB

1. Turn off the controller.
2. Turn off or unplug incoming power to the controller.
3. Remove the enclosure's cover by unscrewing the four cover screws, one at each corner.
4. Disconnect the wires from the interconnect terminal strip.
5. Unplug the CO sensor from the amplifier PCB to access one of the PCB mounting screws.
6. Unscrew and remove the two screws that secure the amplifier PCB to the enclosure. The screws are near the top and bottom of the amplifier PCB.
7. Remove the amplifier PCB.
8. Place the new amplifier PCB in the same position as the one you removed in step 6.
9. Use the two screws you removed in step 5 to secure the PCB to the enclosure.
10. Reconnect the wiring from the controller to the interconnect terminal strip as shown in Table 2 and Figure 3.

Table 2: Reconnecting the CO Transmitter to a Controller

Amplifier PCB Interconnect Terminal Strip	Controller Transmitter Terminal Strip (typical)
FB	4 - 20 (FB)
+V	+ V (10 VDC - 30 VDC)

11. Carefully plug the CO sensor with rubber boot and charcoal filter into the socket pattern on the amplifier PCB.

NOTE: Match the sensor's male pins with the four female sockets as you plug the sensor into the sockets.

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12. Secure the cover to the enclosure.
13. Turn on or plug in incoming power to the controller.
14. Turn on the controller.

CAUTION: *Allow the sensor to warm up for 5 minutes before you continue with the next step.*

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15. Calibrate the CO transmitter as described in the Calibration section of this insert.

Replacing the Charcoal Filter

1. Turn off the controller.
2. Turn off or unplug power to the controller.
3. Remove the enclosure's cover by unscrewing the four cover screws, one at each corner.
4. Unplug the CO sensor from the amplifier PCB.
5. Remove the rubber boot that secures the charcoal filter to the CO sensor.

6. Remove the charcoal filter from the rubber boot.
7. Place the replacement filter in the rubber boot in the same position as the filter you removed in the previous step.
8. Reinstall the rubber boot with charcoal filter to the CO sensor.
9. Carefully plug the CO sensor with rubber boot and charcoal filter into the socket pattern on the amplifier PCB.

NOTE: Match the sensor's male pins with the four female sockets as you plug the sensor into the sockets.

10. Secure the cover to the enclosure.
11. Turn on or plug in power to the controller.
12. Turn on the controller.

Calibration Frequency

Although there is no particular calibration frequency that is correct for all applications, a calibration frequency of every 3 to 6 months is adequate for most CO transmitter applications. Unless experience in a particular application dictates otherwise, RKI Instruments, Inc. recommends a calibration frequency of every 3 months.

If an application is not very demanding, for example detection in a clean, temperature controlled environment where CO is not normally present and calibration adjustments are minimal at calibration, then a calibration frequency of every 6 months is adequate.

If an application is very demanding, for example if CO is present often and in significant concentrations or the environment is not well controlled, then more frequent calibration than every 3 months may be necessary.

Calibration

This section describes how to calibrate the CO transmitter. It includes procedures to prepare for calibration, set the zero reading, set the response reading, and return to normal operation. It describes the test using a calibration kit that includes a calibration cup, calibration gas, sample tubing, and a fixed flow regulator with an on / off knob. RKI Instruments, Inc. recommends using a 0.5 LPM (liters per minute) fixed flow regulator.

NOTE: Calibrating the CO transmitter may cause alarms. Be sure to put the controller into its calibration program or disable external alarms before continuing.

Preparing for Calibration

1. Set a voltmeter to measure in the millivolt (mV) range.
2. Remove the enclosure cover, then plug the voltmeter leads into the test points on the amplifier PCB.

   Plug the positive lead into the test point labeled **CAL+**; plug the negative lead into the test point labeled **CAL-**.

3. Use the following formula to determine the correct test points output for the calibrating sample.

   Output (mV) = (calibrating sample/fullscale) X 400 + 100

   For example, with a calibrating sample of 50 PPM CO and a fullscale setting of 300 PPM, the correct output is 167 mV.

   167 (mV) = (50/300) X 400 +100

4. Place the controller into its calibration program or disable external alarms.

Setting the Zero Reading

1. Screw the regulator into the zero air calibration cylinder.
2. Use the sample tubing to connect the regulator to the calibration cup.
3. Turn the regulator's on / off knob counterclockwise to open it.
4. Hold the calibration cup against the CO sensor's face. Leave the rubber boot and charcoal filter on the sensor when calibrating. Hold the cup on gently to allow gas to escape and avoid pressurizing the sensor's sensing face.
5. Allow the gas to flow for 2 minutes.
6. Verify a reading of 100 mV (± 2mV).
7. If necessary, use the zero pot on the amplifier PCB to adjust the reading to 100 mV (± 2mV).
8. Turn the regulator's on / off knob clockwise to close it.
9. Remove the calibration cup from the sensor face.
10. Unscrew the regulator from the zero air calibration cylinder.
11. Leave the sample tubing connected to the regulator and the calibration cup.

Setting the Response Reading

1. Screw the regulator into the calibration cylinder. Verify that the calibration gas is representative of the transmitter's target gas.
2. Turn the regulator's on / off knob counterclockwise to open it.
3. Hold the calibration cup against the CO sensor's face. Leave the rubber boot and charcoal filter on the sensor when calibrating. Hold the cup on gently to allow gas to escape and avoid pressurizing the sensor's sensing face.
4. Allow the gas to flow for 2 minutes.
5. Verify that the reading matches the response reading (± 2mV) you determined earlier.
6. If necessary, use the span pot on the amplifier PCB to adjust the reading to match the correct response reading.
7. Turn the regulator's on / off knob clockwise to close it.
8. Remove the calibration cup from the sensor face.
9. Unscrew the regulator from the calibration cylinder.

NOTE: For convenience, leave the components of the calibration kit connected by the sample tubing.

Returning to Normal Operation

1. Remove the voltmeter leads from the amplifier test points.
2. Secure the cover to the enclosure.
3. When the display reading falls below the alarm setpoints, return the controller to normal operation.
4. Verify that the controller display reading decreases and stabilizes at 0 ppm CO.
5. Store the components of the calibration kit in a safe and convenient place.

Parts List

Table 6 lists replacement parts and accessories for the CO channel.

Table 3: Parts List

Part Number	Description
06-1248RK	Sample tubing (order by the foot)
07-0203RK	Retaining boot (for filter)
33-7101RK	Filter (charcoal)
57-0035RK-01	Amplifier PCB, CO
65-2434RK	CO transmitter, complete
71-0061RK	*65-2434RK CO Transmitter Manual* (this document)
81-0064RK	Calibration cylinder (50 PPM CO in air; 34 liter)
81-0076RK-01	Zero air calibration cylinder (34 liter)
81-1050RK	Regulator with gauge and knob, 0.5 LPM, for 17 liter and 34 liter steel calibration cylinders
81-1109RK	Calibration cup
ES-1531-CO	CO replacement sensor